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ABSTRACT

The content and quality of the documentation and teachers guides that accompanied 55 educational microcomputer software programs were examined, to determine whether the technical and pedagogical information provided by such guides enabled teachers to fully exploit the instructional potential of the programs. The courseware covered basic elementary and secondary subject areas, and 50 were single disk programs. Results indicated that the multi-disk, multi-level program guides were similar to the single disk guides but did not reflect the complexity of the programs they represented. Most guides adequately covered needed technical information but contained limited pedagogic information. Lack of comprehensive documentation may result in serious school and classroom implementation problems. Faced with an unfamiliar technology and a lack of prior experience in which to place and integrate microcomputer software, teachers will be faced with using a trial and error approach in exploring basic computer applications. This report includes definitions of technical and instructional terms, examples of inadequate and exemplary treatment of elements helpful in using instructional software, and a table of instructional and technical characteristics on which the documentation and teacher guides were rated. (Author/LMM)

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The adequacy of microcomputer courseware teachers guides

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Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, April 1984

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Abstract

As microcomputer software is increasingly used in schools the documentation that accompanies it performs an important function in facilitating its effective classroom use. This paper investigates the content and quality of the documentation and teachers guides that accompanied 55 educational software programs, fifty of which were single disk programs. Programs covered most of the basic subject areas at the elementary and secondary levels.

The study found that while most guides included acceptable technical information for using the program, most did not cover a number of important pedagogic topics including integration of the program into the curriculum. The small number of multi-disk, multi-level program guides analyzed were quite similar to the single disk guides, but did reflect the complexity of the programs they represented. Most guides tended to adequately cover needed technical information, but contained limited pedagogic information.

The paper notes that the lack of comprehensive documentation, especially at this early stage in the introduction of microcomputers into schools may result in serious school and classroom implementation problems; after reading these guides teachers will know how to load and run a program, but will find little help in using the program as part of an on-going instructional plan. Faced with an unfamiliar technology and a lack of prior experience in which to place and integrate microcomputer software the teacher will be faced with using a 'trial and error' approach in exploring basic computer applications. The author notes that based on such a small data base the results of the study are only tentative. No generalizations can be made based on the limited number of multi-disk programs analyzed, although many do seem to share the general characteristics of single disk program manuals.

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Introduction

In the past two years microcomputers have become a fact of classroom life. However, the introduction of this new, unfamiliar technology has created the need for extensive training and support materials to ensure that teachers can effectively use microcomputers and microcomputer software. Although in-service training is overcoming the basic problem of computer illiteracy it is the guides and manuals that accompany educational software that provide the essential underpinning of teacher literacy training and contain information that enables the teachers to fully exploit the educational possibilities of each piece of software.

The function of teachers guides takes on a special importance with microcomputer software for unlike the still dominant form of instructional materials -- the textbook -- there is no tradition of use and experience to provide the intuitive knowledge needed to implement educational software. Although educators may debate the degree to which the guides that accompany textbooks provide too much (and thus unnecessary) help for teachers, such can not be said about the manuals accompanying educational software. For it can be argued that without adequate documentation even the best designed software program will be misused or underutilized.

This study investigates the degree to which the guides accompanying educational software provide adequate technical and pedagogic information to enable teachers to fully exploit the instructional potential of these programs. The research reported here assesses the degree to which teachers guides provide enough information to adequately use the program in a classroom or other educational setting. It provides examples of inadequate and exemplary treatment of various technical and pedagogical elements that are helpful in using educational software.

Method

Fifty-five program manuals, representing all subject areas and grade levels, were analyzed during the Fall, Winter and Spring of 1983-84. Of these programs only five were multi-disk, multi-concept programs. Thus, based on such a limited sample no generalizations are made regarding these multi-disk programs, although it appears that many closely reflected the characteristics of single disk manuals. The software programs had been obtained by EPIE Institute as part of its on-going process of evaluating educational software for its software evaluation service for schools. The software selected for this study had already undergone a rigorous analysis by a team of trained and certified evaluators. This study, also using trained and certified evaluators, extended the already thorough work of the initial analysis by concentrating on a detailed evaluation of the teachers manuals that accompanied the software.

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A checklist was developed that divided possible teacher guide content into content that provided technical guidance and that that provided instructional guidance. Technical guidance items included; information on how to load the microcomputer, manipulation and coordination of components, how to use the control keys, how to change answers, description of the management system and its use, record keeping, the instructional design of the program (for example, branching), and suggestions for the physical arrangement of the equipment. Instructional guidance items included; statements of content, objectives, sample lesson plans, suggestions for curriculum integration, correlations with textbooks, grouping arrangements, follow-up activities, descriptions of support materials, intended users, prerequisite skills for students, and (where appropriate) statements of the readability level of program prose. Detailed explanations of each item can be found in Appendix 1.

Findings: Overview

The manuals analyzed contained more adequate treatment of technical than instructional items. However, while this was generally true for all programs there were marked patterns of omission across all programs and, in some cases, in individual programs (Table 1). On the one hand the majority of manuals contained a full explanation of loading (strangely twelve did not state these procedures at all, five only partly stated them, and two statements were found to be inaccurate), but on the other hand most (33) did not provide any instructions for changing answers. Certain programs were found to be markedly deficient in providing all technical information and this deficiency was usually also characteristic of instructional items. However, despite these omissions -- some quite crucial for fully using the programs, the manuals provided enough information for running the programs and trouble shooting one's way through those items that contained only 'bare bones' information.

Insert Table 1 About Here

Such could not be said for the instructional information in the program manuals. For while most manuals included statements of rationale, curriculum role, descriptions of content (surprisingly some contained only limited information about content), and listings of objectives in various forms, other instructional items were, on the whole, less than adequately covered. Thus, at the extreme the majority of program manuals avoided discussion of subject integration, correlations with other instructional materials, suggestions for grouping, suggestions for further activities, use of support materials accompanying the program, the average time it took to run a program and, where applicable, the readability of prose. For other instructional items, while a majority of manuals included full and partial treatment of them, others did not. Manuals accompanying multi-disk programs, based on the very limited sample included in this study, contained a more extensive treatment of both technical and instructional items. However, this treatment appeared to be a funtion of these programs' more elaborate procedures and content. Overall, little difference was found in multi-disk and single disk manuals. Thus, although 24 programs stated the intended users of programs, 12 did not; 25 provided sample lessons but 16 did not.

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Clearly, the lack of basic information -- partly the result of poor instructional design procedures, hasty design and production, and/or the desire to reach the widest possible audience -- has serious implications for the facility with which teachers can fully use these programs.

The findings in detail: Technical items.

Loading; One of the most basic operations teachers must do to use any program is to load the program into the computer. (The story of a teacher loading a program and seeking help twenty minutes later wondering if it "really took that long to load" is a real one and no doubt not limited to the instance known to the writer). Instructions for loading the program were fully stated in 38 of the 55 manuals analyzed. For example, Lightning Software's *MasterType* manual contained the following instructions, accompanied by an illustration, for loading an Atari computer;

> 1. To begin be certain your Basic cartridge is inserted
>
> 2. insert the MasterType disk in drive 1 and
> 3. turn on your computer.
> Loading the program takes approximately 1.5 minutes. After about 30 seconds, the disk drive will click loudly a couple of times - this is quite normal and lets you know that initial loading is complete and you can press RETURN to begin.
> If you have any problems during booting, double check to make sure you have inserted your BASIC cartridge on 400, 800 and 1200 XL machines.

Instructions from Sunburst's *M-ss-ng L-nks* were as follows:

> 1. Turn on the television or monitor. A black-and-white or color television or monitor may be used.
> 2. Insert the diskette into the disk drive with the label facing up.
> 3. Close the door to the disk drive.
> 4. Turn on the Apple computer. The on-off switch is on the back left side of the computer. (This program may be used on a 48K Apple II or an Apple IIe with Applesoft and DOS 3.3)
> 5. You will see a red light on the disk drive turn on. If the disk drive light does not turn off in about 10 seconds, turn the Apple off and make sure your diskette is placed correctly in the disk drive.
> 6. The SUNBURST logo will appear on the screen, followed by the title of the program.

Less complete loading instructions accompanied five programs. Surprisingly, 12 out of 55 programs manuals analyzed contained no loading instructions -- clearly a serious problem for those unfamiliar with this operation. In two cases analysts found the loading instructions inaccurate (*Space Waste Race* and *Better View a*

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Zoo both by Storybooks of the Future) - a surefire way of confusing the teacher.

Use of Control Keys; The use of control keys was, in the majority (35) of program manuals, adequately described, although the ten programs that only partly stated their use and the ten that did not describe them at all is cause for some concern. The early childhood program *BearJa* (Chalkboard Inc.) provided a comprehensive description of control keys that was typical of many programs (whether it is appropriate to represent basic colors as cherry, blueberry, lemon, lime, grape and marshmallow is another matter);

> Take a Look
> There are five groups of buttons on the BearJam overlay:
> +Six FLAVOR BUTTONS are located in the lower left corner. The flavors represent six basic colors: cherry (red), blueberry (blue)...
> +Six SHAPE BUTTONS are located in the lower right corner: square, circle, triangle, diamond, heart and cross.
> +Five SPACE BUTTONS are located in the center of the overlay between the bear's arms. These buttons, which take the shape of slices of bread, indicate the position of a particlar shape or color on the screen.

MECC's *Special Needs Volume 1* contained the following information;

> *Shift key* - located in the lower left or right-hand corner of the keyboard. When looking at the keys, you will notice two symbols on some keys. If you press the key, you will print the lower symbol. If you press the "Shift" button and a key, you will print the top symbol. For example: If you hold down the "SHIFT" key while you press the semicolon (;), you will get the plus (+) symbol printed.

Instructional Design: Arguably, instructional design is one of the most valuable aides to the teacher. By describing the structure of the program, for example whether it branches, uses random generation etc. the teacher can understand the capabilities of the program and use that knowledge to plan the program's effective use. These descriptions often reveal the sensitivity of developers to instructional design considerations. Users of courseware will find a mixed picture when they refer to the program manuals for an overall view of the instructional design of the programs. For while 22 manuals provided full explanations of design, 32 provided only partial information. Programs such as *Understanding Computers* (Britannica), *Decimals* (Edu-Ware) and *Key Lingo* (Reader's Digest) fully described their instructional design. Other programs were found to be deficient; for example, programs such as *MasterType* (Lightning Software) left its important 'Options' frame unexplained (in addition, while the manual stated that five options will appear, in fact only four do), and *Early Music Games* (Counterpoint Software) contained no mention of feedback, quizzes or random generation -- all characteristics of the program.

Manipulation/Coordination of Components; While many programs we

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analyzed required nothing more than the basic computer (micro, monitor and disc drive) which would already be in place, 28 programs required some manipulation of components. Of those 28, seven contained no information, nine some information and twelve full information for coordinating the various components of the computer. Typical of the manuals containing only partial information were explanations on how to use the printer. The *Homonyms* (Hartley) manual discussed using the program with a printer, but did not deal with the specifics of connection or manipulation. Similarly, *Capitalizaton Plus* (Microcomputer Workshop) contained none of this information either.

How to change answers: Disturbingly, 33 of the manuals analyzed did not describe how users could change answers once they were typed into the computer. Through trial and error it is, of course, possible to discover which keys will rectify an incorrect answer. However, this can be time consuming and should a teacher not have dealt with this problem students will become frustrated as they attempt to correct an answer. In nine cases it was not possible to change an answer at all. Nine manuals contained information on how to change answers with *Wizard of Words* (Educational Computer Games) being typical of the kind of explanation given;

> If you have mispelled a word or entered an incorrect number, use the left arrow key to backspace over the incorrect character until you can enter the correct ones.

Management System; Fifteen of the programs analyzed did not feature a management system. Of the remaining programs 23 were found to contain full descriptions and 15 only partial descriptions of the management system. Complete descriptions of the management system are particularly important because of their complexity. Characteristically, manuals with only partial descriptions of the management system usually omitted certain items such as whether records could be printed out and/or saved, the number of student records that could be stored and so on. For example, Milliken's *Aliencounter and Faceflash* never actually explained what the record system consisted of, although it did explain how it could be accessed and the scores cleared. CTW's *Mix and Match* contained extensive explanations;

> At the end of each game, the computer will ask you if you want to remember what you've taught it until the next time you play. If you type yes, then press RETURN your whole game will be stored on the CTW disk - just like that! Then,next time you play you have a choice. You can go on with the game you stored, or you can start a completely new game. Not bad eh?

Description of Graphics; Of the manuals analyzed six did not describe or illustrate the graphics used in the programs; 22 contained full descriptions and 14 partial descriptions of the graphics. In *Getting the Main Idea* (Learning Well) the following partial description was found;

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> The computer draws a picture for each player. The picture is drawn when the player passes the last city of each turn. A slight delay is sometimes experienced as the computer finds the correct picture.

And as can be seen the actual contents of the graphics were not described; a particularly unfortunate omission as analysts judged the graphics to be stereotyped.

Description of Audio; The use of audio can enhance the effectiveness of a program or disrupt classroom instruction as piercing beeps, tunes and whistles emenate from the 'computer corner.' Thus, it is useful for the teacher to know if audio is part of the program and if it is, if it can be turned off. Unfortunately, 20 of the programs analyzed did indeed feature audio, but no mention was made of this in the accompanying manual (nor obviously, whether it could be turned off). Of the nin full descriptions of the audio feature Britannica's *Math Skills* was typical (to paraphrase); Sounds are produced only if the user specifies Y to the question, "Do you want sounds?" Sound consists of a "click" when a key is pressed, a "buzz" when an incorrect answer is entered, and a "double bell" when a correct answer is entered. In addition, emphasized "clicks" often accompany graphics. Other programs merely mention that audio was a feature of the program.

Description of Feedback; The majority of programs analyzed contained full descriptions of the feedback given to users. In eleven cases feedback was not described and in 14 others only partial information was given.

Physical Arrangements; Only one manual out of 55 contained suggestions for the placement of the computer.

The Findings in Detail: Instructional Items

Rationale; It is always comforting to know that developers of programs have a clearly thought out rationale for their programs. Certainly, it is not unreasonable to expect that developers should have had some instructional philosophy and intent behind their programs. Clearly, just developing a program that describes a microscope because the producers feel like it is not very helpful in establishing its place in instruction and the curriculum. Unfortunately, seven program manuals contained no statements of rationale. The remaining program manuals all contained rationale statements; some were elaborate other fairly simple:

> :Developed to meet the apparent need for reinforcement material in comprehension skills, employing a gaming approach. (*Alphabetizing - Red and Blue Levels.* Learning Well)
>
> :Math facts are most effectively learned through dri]).... (This program aims) to excite kids about

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drilling math facts. (*Math Invaders*. Winners Circle).

:One of the most important skills that we can help students develop is in the area of problem solving. It does not seem appropriate to use advanced technology such as computers to help students practice rote skills that the computer can replace. For example, computer programs that help students develop paper-pencil techniques for solving algebraic equations may not be appropriate if mathematicians in industry no longer use such paper-pencil techniques for solving equations.

The ability of computers to reason and think is very limited; however, computers are very good at lower-level computational skills. Humans must focus on what humans can do best, namely, think and solve problems. It is more important for a human to know *when* to multiply two numbers.

Thus COMP-U-SOLVE deals with one of the most important objectives in the school curriculum - PROBLEM-SOLVING! (Educational Activities *COMP-U-SOLVE*)

Curriculum Role: *Instant Zoo* and *Alpine Skier* are typical of the titles of much software. These titles, while attractive are not particularly informative and so it is important that developers actually state the subject area their program fits into and, as important, the type of program it is. This latter item is especially helpful, for if the teacher knows that program X provides drill and practice for students then that will result in a different use of the program than one that is a simulation. Fortunately, most of the manuals we analyzed contained this information. Eight did not.

Description of Content; In all cases program manuals contained descriptions of content. The information is important in helping teachers assess how and when the program should be used in instruction. Analysis of manuals found that content descriptions differed only in terms of detail; some contained comprehensive lesson by lesson content descriptions, others general statements of content covered.

Objectives; Although the specificity of objectives varied from program to program, with some so general as to be classified as goals, most program manuals featured reasonably complete objectives. Thirty-nine programs listed acceptable objectives i.e. those that would allow the teacher to judge the purpose and expected outcomes of a particular program. Six manuals did not list objectives at all and ten contained incomplete objectives such as Hartley's *Who, What, Where, When and Why* - "Given a phrase, the student must discriminate when, where" (this was the only objective in the whole manual). More comprehensive objectives were a feature of programs such as the following;

The student will be able to arrange words in the correct alphabetical order.

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(*Alphabetizing Red and Blue Levels*. Learning Well)

1. form accurately each capital and small letter and numeral;
2. become aware of the necessary strokes required in each letter and numeral;
3. practice individual strokes;
(*Floppy Teaches: How to Print*. Floppy Enterprises)

MATH BLASTER was designed to accomplish three major objectives:
1. to help you memorize math facts that are essential to building basic math skills;
2. to help improve your accuracy and increase your speed;
3. to build math skills in an interesting, entertaining, and effective way.
(*Math Blaster*, Davidson & Associates)

Sample Lessons: Sample lessons provide a step-by-step, frame-by-frame description of the program. Such a feature allows the teacher to get an advanced idea of the program before using it and can mean a reduction of needless head scratching as he/she tries to figure out how to input choices or use the menu. Sixteen of the manuals analyzed did not contain sample lessons; 25 contained full descriptions. The Learning Company's *Bubble Bases* was typical of programs that gave comprehensive sample lessons;

> This game is for two at a time to play, so take turns with a friend. You play Tic Tac Toc on a set of points made by lines that cross each other. That is called a grid. The "X" number along the side tell you how far you are from the bottom.
>
> To win Tic Tac Toc you try to choose four points on the grid in a straight line up, down, or at an angle. But it has to be a line. And you only get to choose one point each turn.
>
> To choose a point on the grid you first type the X number, then type a comma "," and then (illustrations) type the Y number. Then push the RETURN button...Watch what the winner gets on the screen!

Intended Users; Many of the program manuals contained only vague or n statements of intended users. This omission seemed to be a common one; presumably producers hope to have as broad an age and ability range as possible use their programs. This, of course, can cause difficulty when elementary and special education students are specified by Educational Activities' *Our Wierd and Wacky World* or when "Ages 10 and up" are specified by ATX's *Atlas of Canada*. But this causes not as much difficulty as the programs which list no age or grade level), such as in Media Basics Course's *Return to Reading: The Red Badge of Courage* or ECS's *Elements of*

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Mathematics: Adding Fractions. Twenty four manuals fully stated the intended users; 19 had broad classifications and 12 no information at all.

Entry Level Skills; Entry level skills were, in the main, only partly stated for most programs -- not surprising given the broad age range that most programs listed. Thus, 32 programs contained only partial entry level skill information, 11 contained no information and 11 complete information. Complete information was included in Sunburst's *Challenge Math* which listed in detail all the math skills needed for each of its three games, as well as more general skills listed at the beginning of the program. Britannica's *Math Skills* manual listed the following information;

> Users should be able to read at a minimal level to use these programs effectively. At the elementary level, the program titled "Numbers" might be used by children as early as the end of the first grade. Sections with more advanced math content require the use of specialized vocabulary, such as numerator and decimal point, that would probably not be readable by younger children without the assistance of the teacher.
>
> It would also be helpful if students were already familiar with the basic operation of the computer system available to them...In addition, the scoring display, which is explained later, requires...the ability to write down and report scoring information to the teacher.

Time to Run; The great majority of programs (44) did not indicate how long or approximately how long it took to run each program. This presents special problems for planning to use programs in the classroom. (EPIE Institute provides this information after extensive trials in its Software PRO/FILES).

Readability of Text; The level of difficulty of the text in programs was not stated in 28 of the manuals analyzed. Seven manuals contained precise readability formula levels such as Sunburst's *Challenge Math* (which listed Spache derived readability levels), Sierra On-Line's *Troll's Tale* and Learning Well's, *Alphabetizing*;

> Your child can work through the game independently if he or she is able to read at third grade level. The vocabulary is controlled and all the instructions are on the disk. (*Troll's Tales*)
>
> The Red Level Edition uses words selected after careful review of basal texts and standard word lists. The words in this game represent a 2.0-3.5 vocabulary ability. There are four sets of words. Each set represents a greater degree of difficulty progressing from 1. where most words only require checking to the second letter for alphabetical arrangement, to set 4, where a significant number of words require third and

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fourth letter verification for correct alphabetical arrangement. (*Alphabetizing*)

Eleven contained partial readability levels such as Funk Vocab-Ware's *Power of Words* statement that the program text was at the high school through college level.

Correlations with Textbook; None of the programs analyzed made any suggestions for using them with a classroom textbook. Thus, there were no suggestions for correlating content topics and objectives with those of the textbook.

Support Materials; Thirty five of the programs analyzed were accompanied by support materials such as worksheets, parent letters, score sheets and activity sheets. However, fifteen of these programs contained no suggestions for using these materials. Of the 13 programs that contained fully stated suggestions for using the support materials two were typical;

> We offer these suggestions for using the eight reproducibles contained in the MathFun packages.
> +LETTER TO PARENTS - Computer learning is still new to many people. Keep parents "on your side" by sharing this program with them. If you do not want parental visits the last lines can simply be covered with white paper before being reproduced. (A letter is provided for each game in the package.
> +COMPUTER SCHEDULE (by class) - Fill out and post it in the classroom or computer center. Students can then work independently...
> (*Aliencounter and Faceflash* Milliken)

> It generally takes a long time for children to develop skill in mapping a region. They need lots of practice. So we've enclosed an outline map of the Troll's territory. Your child can map the journey by labeling the circles (with words or drawings) and adding lines to connect them. Each time your child finds one of the treasures, the location can be marked with a peel-off sticker. In addition, the compass decal will serve as a direction guide throughout the game. Just peel it off and place it on the monitor near the screen.
> (*Troll's Tale*, Sierra On-Line)

Suggestions for further activities; Few manuals contained suggestions for activities prior to using the program or after using it. Nine manuals gave only partial suggestions and quite obvious ones at that such as discussing program content after program completion. Eight gave more detailed suggestions. *Aliencounter and Faceflash* (Milliken) was typical;

> 1. For fun math drill, save your old calendars. Have students select a month and use the numbers in many ways: add the rows horizontally and vertically, add all Tuesdays and Fridays, add all even numbers, etc.

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> 2. Divide your students into two teams. Give each student on team 1 a number card. Give duplicate cards to team 2. Call out an addition problem. The first team to hold up the correct card (answer) wins a point. Set a time limit and repeat until the time is up. The team with the most points wins.

Suggestions for grouping; If a teacher has just one computer in his/her classroom how is that computer to be used so that as many students as possible get to use it. One solution is to use the computer for group instruction. Manuals were analyzed for suggestions for using the program with more than one student. Thirty of the program manuals analyzed contained no information on grouping. However, 19 contained useful suggestions. For example, Sunburst's *Challenge Math* noted that "Once the students are familiar with the instructions the program is also excellent for use as a competitive game between individuals or teams." Edu-ware Services' *Edu-ware Decimals* contained the following suggestions;

> With a single computer in the classroom, the teacher may choose to use that computer as a group instructional tool. If the computer is placed in the room with two or more monitors connected to it, the teacher either does the data entry personally or have a student do it, as classroom instruction is delivered to the entire watching class. The problems which appear on the screen can be answered by individual members of the class, with the teacher or learner entering the correct response as provided by the learners. Thus the DECIMAL system can become a powerful group interactive tool for the delivery of instruction.

Subject Integration; This topic is, perhaps, one of the most important for the success of computer instruction will depend on the extent to which they can become part of the established curriculum. Suggestions for integrating programs into the curriculum are therefore important in helping teachers to routinely use computer programs as part of their on-going instructional plan. The analysis of manuals revealed that the majority of programs contained little information for integrating the computer and its educational software into the curriculum. Indeed, 35 program manuals contained no information, three manuals were judged as providing comprehensive information and 14 only partial information. On the whole suggestions tended to be quite general. For example, Funk Vocab-Ware's *Power of Words*, was an example of fairly general suggestions, whereas DLM's *Arcademics Math Skill Builders* contained specific suggestions;

> You can employ the program as the principle vocabulary-development course or as a supplement to an existing one...Your students can work on the program during assigned periods or in their free time... (*Power of Words* Funk Vocab-Ware)

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Milliken's *Aliencounter and Faceflash* contained the most comprehensive suggestions for curriculum integration:

> science teacher might use objects as a shell, leaf, seed, magnet etc. (Level K-4)
>
> Use classification folders in any subject area to enable child to note similarities and differences among objects. Place category labels on file folders and add an envelop full of pictures to be sorted.Examples of various curriculum areas include:
> science - classify animals as air/land/sea
> health - classify as fruits/vegetables
> math- group sets by number of objects

Conclusion

Based on the limited sampling of courseware manuals a number of tentative conclusions were found. The analysis of the manuals and guides accompanying educational software programs revealed that many of these manuals left much to be desired in providing information necessary to use these programs in an educational setting. While there were programs that were clearly better than others in providing a wide range of information many others provided less comprehensive information. While technical information tended to be more thoroughly covered than instructional information, there seemed to be no consistent pattern to the omissions in both types of information in the manuals. Even items which were most frequently covered by manuals such as loading, intended users, subject area etc. were not consistently covered.

The failure of manuals to address such items as how to change answers, physical arrangements for the computers, audio (and how to turn it off), sample lessons, subject integration, suggestions for further activities etc. are serious omissions. And while many programs were considered to contain enough information that a teacher could infer missing information, there were a number of instances when there simply was not any information on which to base those inferences.

Clearly, there seems little consensus in the industry about what a manual should consist of. Manuals range from a sparsely covered page of instructions to booklets of many pages. In these latter manuals it is apparent that experienced educators and instructional designers were at work and although they, too, often omitted certain information the teacher, having read these manuals, are much better prepared to use these programs.

As teachers become more knowledgeable about computers and they become a familiar part of their instructional materials inventory (indications are that this will not happen soon) certain information which we now expect to find in manuals, will not be needed. For example, loading, physical arrangements, and manipulation and coordination of components should eventually become so obvious that they will not be needed. But, other items seem of continuing importance and without adequate information to ensure that these

programs are used their potential remains unexploited.

It seems clear that producers should make an extra effort to improve their teachers manuals. Until that happens teachers, after reading manuals will know how to load and run a program, but will find little help in using the program as part of an on-going instructional plan. And faced with an unfamiliar technology and a lack of prior experience in which to place and integrate microcomputer software the teacher will be faced with using a 'trial and error' approach in exploiting basic computer applications.

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Table 1

Characteristics of 55 single disk and multi disk manuals

TECHNICAL	F/S	N/S	P/S	N/A	S	D
Loading	38	12	5	0	0	2
Use of control keys	35	10	10	0	0	0
Instructional design	22	1	32	0	0	0
Manipulation/coordination of components	12	7	9	27	0	0
How to change answers	9	33	0	9	2	0
Description of management system	23	2	15	15	0	3
Description of graphics	22	6	14	5	8	0
Description of audio	9	20	11	12	2	1
Description of feedback	24	11	14	0	6	2
Physical arrangements	1	54	0	0	0	0
INSTRUCTIONAL						
Rationale	0	7	0	0	48	0
Curric. role	41	8	6	0	0	0
Desc. of content	36	0	19	0	0	1
Objectives	39	6	10	0	0	1
Intended users	24	12	19	0	0	1
Sample lessons	25	16	13	1	0	0
Entry level skills	11	11	32	0	1	0
Subject integration	3	35	14	3	0	0
Correl. w/ textbook	0	54	0	0	1	0
Suggestions for grouping	19	30	4	0	2	0
Suggestions for further activities	8	38	9	0	0	0

Support materials	13	15	6	20	1	0
Readability of prose	14	28	11	2	0	0
Time to run	7	44	1	1	0	0

n=55

F/S, fully stated; N/S, not stated; P/S, partly stated; S, stated; N/A, not applicable; D, discrepancy.

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Appendix 1

Definitions of technical and instructional items

Loading; fully stated when a beginner would be able to successfully complete task.

Use of control keys; keys required for using program are clearly described. For example, if an arrow is used for reverse this is clearly stated.

Instructional design; description of activity menu, options, exiting procedures, user control, random generation and branching.

Manipulation/coordination of components; description of additional components needed to use program e.g. printer, joystick, touch sensitive pad, and how to hook them up to the computer and use them.

How to change answers; if answers can be changed the user is told the exact procedure to use.

Description of management system; each component of the management system is described and includes information about student records, tests, access procedures.

Description of graphics; content of graphics, contingencies, purpose.

Description of audio; presence or absence of audio, length of melody, placement, type, activation, deactivation.

Description of feedback; type, when used.

Physical arrangements; where to place the computer, light reflection/noise precautions.

Rationale; purpose of the program.

Curriculum role; subject area and type of program.

Description of content; content topics.

Objectives; statements of learning activities and expected learner outcomes.

Intended users; target audience, specific age or grade range.

Sample lessons; step-by-step description of lesson, including menu, input choices, feedback, activities and record keeping system.

Entry level skills; skills needed to successfully work with program.

Subject integration; how program can be used as part of on-going instruction.

Correlation with textbook; how to correlate program content with textbook objectives and content.

Suggestions for grouping; applicability with groups, monitoring/instructional strategies.

Suggestions for further activities; pre- and post- program activities.

Support materials; description, application.

Readability of prose; by readability formula.

Time to run; approximate time.

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